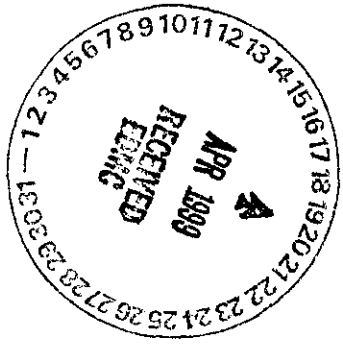
**Department of Energy**
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

066925

MAR 3 1999

Ms. Laura J. Cusack
Project Management Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336-6018




Dear Ms. Cusack:

INTERIM CHANGE NOTICES (ICN) FOR RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) GROUNDWATER (GW) MONITORING PLANS

Attached please find ICNs for seven GW monitoring plans, for your information. The following table summarizes the attached ICNs:

| ORIGINAL PLAN TITLE | SUMMARY OF CHANGE | ICN Date |
|---|---|---|
| Interim-Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch | Updates references to QA plan, procedures, and cautions of wells going dry soon. | 9/17/97 |
| Interim-Status Groundwater Quality Assessment Plan for the 216-U-12 Crib | Updates references to QA plan, procedures, and presents plans for new well. | 9/23/97 |
| Interim-Status Groundwater Monitoring Plan for the Single-Shell Tanks | Presents plans for new wells and associated hydrogeologic characterization. | 6/02/98 |
| Revised Groundwater Monitoring Plan for the 200 Areas Low-Level Burial Grounds (WMA2) | Modify the monitoring network for WMA 2 due to changing flow directions. | 7/20/98 |
| Revised Groundwater Monitoring Plan for the 200 Areas Low-Level Burial Grounds (WMA4) | Modify the monitoring network for WMA 4 due to groundwater flow reversal from ZP-1 pump and treat. | 7/20/98 |
| Combination RCRA Groundwater Monitoring Plan for the 216-A-10, 216-A-36B, and 216-A-37-1 PUREX Cribs | Modify the frequency of sampling far-field wells from annual to once every three years. | 11/30/98 |
| Interim-Status Groundwater Monitoring Plan for the 216-B-3 Pond | Returns monitoring to semiannual detection level from quarterly assessment. | 12/10/98 |

The GW monitoring activities as required for RCRA are conducted in accordance with the GW monitoring plans, which are maintained in the Pacific Northwest National Laboratory (PNNL) Hanford GW Monitoring Project files. The plans meet the interim status requirements of WAC 173-303-400(3) (by reference to 40 CFR Part 265 Subpart F). Periodically, revisions or updates of a GW monitoring plan are needed as a result of changes in site hydrogeologic conditions, monitoring well networks, or monitoring parameters. Revisions to the plans are documented and controlled by means of ICNs according to PNNL document control procedures.

If you have question regarding these plans, please contact me at 373-9630.

Sincerely,

M. J. Furman, Project Manager
Groundwater Project

GWP:MJF

Attachment

cc w/attach:
B. M. Barnes, WMH
J. V. Borghese, CHI
J. Donnelly, Ecology
C. C. Haass, LMHC
M. Jaraysi, Ecology
S. Leja, Ecology
S. P. Luttrell, PNNL
T. Valero, Ecology

# INTERIM CHANGE NOTICE
## (ICN)

ICN – PNNL-11523 R0.1
Page 1 of 1

*A.*

**Document Number:** PNNL-11523 **Revision Number:** R0

**Document Title:** Combination RCRA Groundwater Monitoring Plan for the 216-A-10, 216-A-36B, and 216-A-37-1 PUREX Cribs

**Document's Original Author:** JW Lindberg

**Effective Date of ICN:** 11 / 30 / 98

**Change Requested by:** JW Lindberg

*B.* **Action:**

Replace pages 5.7 and 5.8 with the attached 2 pages. Attach this ICN to the front of the document.

On page iii, the third paragraph, third sentence, strike out the word "annually" and replace with "at least once every three years". Initial and date change, and place the ICN# near the change.

Add the following reference to the reference list on page 6.2:
Hartman, M.J., P.E. Dresel, J.P. McDonald, R.B. Mercer, D.R. Newcomer, and E.C. Thornton. 1998. *Integrated Monitoring Plan for the Hanford Groundwater Monitoring Project*, PNNL-11989, Pacific Northwest National Laboratory, Richland, Washington. Initial and date change, and place the ICN# near the change.

*C.* **Effect of Change:**

The schedule for sampling far-field wells changes from annual to once every three years.

*D.* **Reason for Change/Description of Change:**

The far-field wells sample the large regional plumes (nitrate, tritium, and iodine-129). Major changes in these large plumes occur very slowly. The Washington State Department of Ecology has agreed to allow a reduction in the frequency of sampling these larger, more regional plumes from annual sampling to sampling once every three years. The results of sampling these far-field wells are also used by the general site surveillance portion of the overall Hanford Site Groundwater Monitoring Program.

*E.* **Approval Signatures:**
**(Please sign and date)**

**Type of Change: (Check one):**

____ Minor X Major

Process Quality Department: TL Almeida TL Almeida Date: 11/24/98

Approval Authority: RM Smith/SP Luttrell (Project Management) Date: 11/24/98

Other Approvals: JW Lindberg (Technical) JW Lindberg Date: 11/24/98

: MJ Hartman (Technical Review) Mary J Hartman Date: 24 Nov 98

Table 5.1. Proposed Groundwater Monitoring Network

**Far-Field Wells (Within 2,000 pCi/L Tritium Plume)**

Sampled Once Every Three Years (As a Minimum)

| | | | |
|---|---|---|---|
| 699-47-5 | 699-46-21B | 699-46-4 | 699-43-3 |
| 699-42-12A | 699-41-1 | 699-41-23 | 699-40-1 |
| 699-38-15 | 699-35-9 | 699-33-42 | 699-32-43 |
| 699-32-22A | 699-31-11 | 699-31-31 | 699-29-4 |
| 699-28-40 | 699-27-8 | 699-26-15A | 699-25-33A |
| 699-24-34B | 699-22-35 | 699-21-6 | 699-20-E12 |
| 699-20-20 | 699-20-E5 | 699-17-5 | 699-10-E12 |
| 699-9-E2 | 699-8-17 | 699-8-25 | 699-2-3 |
| 699-2-7 | 699-1-18A | 699-S3-E12 | 699-S6-E4A |
| 699-S6-E14 | 699-S19-E13 | 699-S19-E14 | 699-S0-7 |
| 499-S0-8 | 399-1-18A | | |

**Far-Field Wells (Immediately Outside 2,000 pCi/L Tritium Plume)**

Sampled Once Every Three Years (As a Minimum)

| | | | |
|---|---|---|---|
| 699-48-7A | 399-6-1 | 699-40-33A | 699-24-46 |
| 699-19-43 | 699-14-38 | 699-S3-25 | 699-S8-19 |
| 699-S12-3 | 699-S31-1 | 699-S27-E14 | 699-S29-E16A |

**Near-Field Wells**

Sampled Semi-Annually (except for one well at each crib[b])

Upgradient

299-E24-18[a] (A-10 Crib)
299-E25-31[a] (A-37-1 Crib)

**Downgradient**

| A-10 Crib | A-36B Crib | A-37-1 Crib |
|---|---|---|
| 299-E17-1 | 299-E17-14[a,b] | 299-E25-19[b] |
| 299-E24-16[a,b] | 299-E17-17[a] | 299-E25-17 |
| 299-E17-19[a] | 299-E17-9 | 299-37-47A[a] |

(a) Well meets standards of WAC 173-160
(b) Well sampled quarterly

wells will be added. Conversely, in areas where the tritium concentration drops below 2,000 pCi/L, wells will be dropped from the list. The same wells will be adequate to monitor the I-129 and nitrate plumes because they are within the area covered by the tritium plume.

Although the majority of proposed far-field wells do not meet the construction requirements of WAC 173-160 (and are by reference not RCRA compliant), they are considered adequate to meet the far-field monitoring requirements of this plan for the following reasons:

1. Well construction materials (i.e., casing of carbon steel with or without stainless steel screen) will not react adversely with the constituents of concern.

2. The Hanford Site is in an arid environment where the lack of surface and annular seals is not expected to allow water to move through the well annulus. Furthermore, most wells are screened or perforated at, or immediately below, the water table. Inter-aquifer communication is not a problem.

Several of the wells are screened in deeper portions of the unconfined aquifer. These wells will be sampled to help provide and indication of the vertical nature of the plumes.

The issue of the anomalous U and As found below the Ringold Formation lower mud unit in well 699-37-47A remains unresolved. With the data collected thus far, it is not possible to completely rule out past PUREX operations as a source for the U and As. This issue will continue to be examined as additional data are received from well 600-37-47A and other wells surrounding the PUREX cribs and more information is gathered about the operational history of the PUREX Plant.

### 5.3.3 Determination of Groundwater Flow Paths

In addition to measuring depth to water in all wells at the time of sampling, water levels will be measured annually during a month that is representative for the year (assuming that the month chosen does not typically exhibit severe weather that would interfere with the taking of field measurements). The larger data set will be used to construct water table maps and estimate the direction of groundwater flow and the horizontal hydraulic gradient.

### 5.3.4 Sampling and Analysis

The majority of the near-field network wells will be sampled semi-annually. Three wells, one in or near each of the PUREX Cribs, will be monitored quarterly. Two of these three wells are compliant with WAC 173-160 and are immediately downgradient of each of the cribs they are near (there are no RCRA-compliant wells near the A-37-1 Crib). Data from these three wells will be assessed quarterly to determine if there are any changing contaminant conditions near the cribs (required by 40 CFR 265.93[d][7][I]. Far-field wells will be sampled (as a minimum) once every three years because in these more distant areas major changes in plume characteristics occur very slowly. The schedule for sampling the far-field wells is designed to be consistent with the Hanford Site Surveillance Monitoring Network (Hartman et al. 1998). The list of far-field wells (Table 5.1) is subject to change based on the needs of site surveillance monitoring. Depth to water will be measured before samples are collected. The wells will be purged, and samples will be collected after

# INTERIM CHANGE NOTICE
## (ICN)



A.
**Document Number:** WHC-SD-EN-AP-018 **Revision Number:** 0

**Document Title:** Interim-Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch

**Document's Original Author:** S.P. Airhart

**Effective Date of ICN:** 9/17/97

**Change Requested by:** H. Hampt

B. **Action:** Replace pages 41-66 with pages 41-45 distributed with this ICN. Replace pages 73-76 with pages 73-76 distributed with this ICN. Replace Table of Contents, page 5 with page 5 distributed with this ICN. Attach the ICN to the existing document.

C. **Effect of Change:** NA

D. **Reason for Change/Description of Change:** The groundwater monitoring plan (WHC-SD-EN-AP-018, Rev.0) provides outdated information about the groundwater monitoring network. The added pages provide current information on the S-10 Facility groundwater monitoring network, as well as information on anticipated changes to the monitoring network.

E. **Approval Signatures:**
(Please sign and date)

**Type of Change: (Check one):**

✓ Minor __ Major

**Process Quality Department:** Taffy Almeida T L Almeida **Date:** 9/5/97
Stuart P. Luttrell **Date:** 9/17/97

**Approval Authority:** Ron M. Smith **Date:** 9/10/97

**Technical Approval:** Heidi Hampt **Date:** 9/4/97

**Technical Reviewer:** Jon Lindberg **Date:** 9/4/97

## CONTENTS

# PHASE I – GROUNDWATER MONITORING PROGRAM

This plan has been developed in accordance with 40 CFR 265, Subpart F to conduct an interim-status groundwater monitoring program for the 216-S-10 Facility. All work outlined in this plan shall be conducted using the *Quality Assurance Project Plan for RCRA Ground-water Monitoring Activities* (WHC 1995) or equivalent PNNL documents and *Procedures for Groundwater Investigations* (PNL-MA-567). Work by subcontractors shall be conducted to their equivalent standard operating procedures. All work performed in support of this plan shall be conducted in accordance with the *Pacific Northwest National Laboratory Quality Assurance Manual* (PNL-MA-70).

## HISTORY

Quarterly RCRA sampling of groundwater under a detection level program was initiated in August, 1991. Quarterly sampling was completed in June 1992 after four periods of sampling; the site has been on a semiannual sampling schedule since that time. The calculated critical means for Total Organic Carbon (TOC) and Total Organic Halides (TOX) from the quarterly sampling completed in 1992 were less than the Limit of Quantitation (LOQ). The LOQ has been used for semiannual upgradient/downgradient comparisons. In December 1996, quarterly background sampling for TOX was re-initiated because the TOX concentration was rising in the background wells. The quarterly sampling for TOX will be complete by September 1997.

## OBJECTIVES

The objectives of the S-10 Facility groundwater monitoring program are the following:

- determine the horizontal and vertical groundwater flow directions beneath the S-10 Facility in the uppermost unconfined aquifer,
- establish the background groundwater chemical conditions beneath the S-10 Facility
- determine whether any statistically significant amounts of hazardous waste constituents originated from the S-10 Facility have impacted the groundwater beneath the facility by comparing the concentration of indicator parameters to background groundwater per 40 CFR 265.91 and 265.92.
- prepare an outline for a groundwater quality assessment program for the S-10 Facility.

## APPROACH

This section presents an overview of the groundwater monitoring program at the S-10 Facility.

Six wells were installed to complete the groundwater monitoring system around the S-10 Facility and to provide information to help characterize the hydrogeology at the facility. The locations of these wells are shown in figure 3.1. Wells 299-W26-7, 299-W26-8, 299-W26-9, 266-W26-10, and 299-W26-12 were installed at the top of the unconfined aquifer. These wells provide information on groundwater flow direction and water quality from the uppermost portion of the unconfined aquifer. Wells 299-W26-7 and 299-W26-8 were installed upgradient of the S-10 Facility as background wells. Well 299-W27-2 was installed at the base of the unconfined aquifer. This well provides information on vertical hydraulic flow within the unconfined aquifer and the quality of the water in the lowest portion of the unconfined aquifer.

A decrease in liquid waste disposal to the ground at the Hanford Site has caused a lowering of the groundwater mounds that affect the water table under the S-10 Facility. As a result, several wells at the S-10 Facility will go dry in the next several years. The well that is predicted to go dry first is the upgradient well 299-W26-8. At present there are no plans to replace that well when it does go dry. Well 299-W26-7 will remain as the sole upgradient well at the S-10 Facility. Historical background data from 299-W26-8 will continue to be used for downgradient comparisons. It is possible that the existing well 299-W26-6 may be used for gathering supplemental background information. Well 299-W26-6 is not compliant with WAC 173-160 so its use will be limited.

## DETECTION LEVEL GROUNDWATER MONITORING SYSTEM

This section describes the aquifer that is monitored, the location of the monitoring wells, the drilling of the monitoring wells, the frequency of sampling, and the groundwater constituents that are analyzed.

Subsurface sediments were obtained during drilling. These samples were described and classified in the field, and selected samples were analyzed for various physical and chemical parameters. Aquifer tests were conducted to provide estimates of hydraulic properties of materials beneath the site (WHC 1991, WHC 1992, WHC 1993).

### Identification of Aquifer to be Monitored

The unconfined aquifer beneath the S-10 Facility is contained primarily within the sediments of the Ringold Formation and extends to the top of the fine-grained facies of the basal Ringold/lower Ringold units or the top of basalt where the mud is not present. The unconfined aquifer is discussed in more detail in Chapter 2.0. Hydrogeologic characterization activities were designed and planned to obtain information on hydraulic and flow characteristics of the uppermost aquifer.

### Background (Upgradient) Wells

Two wells (299-W26-7 and 299-W26-8) were originally installed as background wells to determine the background water chemistry. Wells 299-W26-7 and 299-W26-8 were completed in the top of the unconfined aquifer in the Ringold Formation. The screens for these wells intersect the saturated zone. As explained previously, well 299-W26-8 is going dry due to a decline in the water table throughout the separations area. Well 299-W26-7 will serve as the upgradient well when samples can no longer be collected from 299-W26-8.

### Detection (Downgradient) Wells

Four wells (299-W26-9, 299-W26-10, 299-W26-12, and 299-W27-2) were installed as downgradient detection wells. Wells 299-W26-9, 299-W26-10, and 299-W26-12 were completed in the top of the unconfined aquifer in the Ringold Formation. The screens for these wells intersect the saturated zone. Well 299-W27-2 was completed near the base of the unconfined aquifer in the Ringold Formation.

### Proposed RCRA Monitoring Wells

Some downgradient wells that are part of the groundwater monitoring network for the S-10 Facility may go dry in the next couple of years. Presently there are no plans to replace those wells; however whether or not those wells will be replaced will be evaluated in the future.

### Well Drilling and Construction

The groundwater monitoring wells were constructed at the S-10 Facility as RCRA-standard wells according to WAC-173-160, "Minimum Standards for Construction and Maintenance of Wells." Geologic and construction diagrams for the S-10 Facility are included in Appendix B. Borehole data packages that describe well drilling and construction have been compiled for each S-10 well (WHC 1991, WHC 1992, WHC 1993). A short summary of the well drilling and construction information is presented below.

The procedures controlling well site activities during the drilling of wells 299-W26-7, 299-W26-10, 299-W26-12, and 299-W27-2 are given in "Environmental Investigations and Site Charaterization Manual" (WHC 1988). "Generic Specification for Groundwater Monitoring Wells, Rev. 4" (Hodge 1990) provided the specifications for well site activities during the drilling of wells 299-W26-8 and 299-W26-9.

**Well Drilling.** Wells 299-W26-7, 299-W26-10, 299-W26-12, and 299-W27-2 were constructed to the specifications in "Generic Specification for Groundwater Monitoring Wells, Rev. 6 (WHC 1991). Construction, completion, and documentation followed the

procedures presented in WHC (1988). Wells 299-W26-8 and 299-W26-9 were installed according to "Generic Specifications - Groundwater Monitoring Wells" (Hodge 1990). Construction, completion, and documentation of the wells were performed according to procedures outlined in "Procedures for Ground-water Investigations" (PNL 1989) and "A Field Guide for Well Site Geologists: Cable Tool Drilling" (Last and Liikala 1987).

The S-10 Facility wells were drilled with a cable tool rig except for well 299-W27-2 which was drilled with an air rotary rig.

Chemical health and safety monitoring was conducted in accordance with the site-specific health and safety plan (KEH 1990). Radiological surveys were also performed. No detections above site background levels were measured (WHC 1992, WHC 1993).

**Well Construction.** A construction summary for the S-10 Facility wells is presented in Table 3.1. Hydrostar[1] sampling pumps are installed in the S-10 Facility wells.

**Table 3.1. Construction Summary for the S-10 Facility Groundwater Monitoring Network**

| Well Number | Year Drilled | Survey Date | Reference Datum | Top of Casing [m (ft)] | Drilled Depth [m (ft)] | Depth to Water [m (ft)] | Screened Interval [m (ft)] | Screen Slot Size [mm (ft)] |
|---|---|---|---|---|---|---|---|---|
| 299-W26-7 | 1991 | 1991 | NGVD29 | 198.7 (652.0) | 63.1 (206.9) | 60.5[97] (198.6) | 56.1-62.5 (184.2-205.2) | 0.1 (0.005) |
| 299-W26-8 | 1990 | 1990 | NGVD29 | 203.1 (666.3) | 65.7 (215.7) | 65.4[97] (214.7) | 59.6-65.7 (195.4-215.7) | 0.2 (0.01) |
| 299-W26-9 | 1990 | 1990 | NGVD29 | 199.4 (654.2) | 62.8 (206.2) | 61.7[97] (202.5) | 56.3-62.5 (184.6-204.9) | 0.2 (0.01) |
| 299-W26-10 | 1991 | 1991 | NGVD29 | 204.5 (670.87) | 68.0 (223.0) | 67.0[97] (219.8) | 61.3-67.5 (201.2-221.3) | 0.2 (0.01) |
| 299-W26-12 | 1991 | 1991 | NGVD29 | 206.0 (675.7) | 70.1 (230.0) | 68.4[97] (224.5) | 63.2-69.5 (207.2-227.9) | 0.2 (0.01) |
| 299-W27-2 | 1992 | 1992 | NGVD29 | 206.4 (677.1) | 132.6 (435.0) | 68.5[96] (224.6) | 123.8-127.0 (406.1-416.6) | 0.5 (0.02) |

Notes:
Shading denotes upgradient wells.
NGVD = national geodetic vertical datum.
Superscript following water level indicates the last sampled period.

## Sampling and Analysis

**Sample Collection.** The depth to water is measured before the wells are purged. After a well has been purged, samples are collected. Purging is considered complete when at least three borehole volumes have been purged; the temperature, specific conductance, and pH have stabilized; or, in the case of wells screened in very low permeability materials, after the well has recharged.

[1] Hydrostar is a registered trademark of Instrumentation Northwest, Inc.

**Sample Frequency and Analytical Procedures.** Samples are collected semi-annually from all groundwater wells in conformance with 40 CFR 265 Subpart F for the analysis of the constituents listed in Table 3.2. Additional constituents are added if a need for a particular constituent exists. Sampling is conducted by a subcontractor according to a Statement of Work. Samplers follow the sampling, preservation, and chain-of-custody procedures for their company. Analytical work is conducted under a Statement of Work. Methods for analytical work conform to the *Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods* (SW-846) (EPA 1986) or appropriate, recognized methods in situations where an SW-846 method is not appropriate. Quality control activities help to ensure the reliability and validity of field and laboratory measurements. All work shall be conducted using the *Quality Assurance Project Plan for RCRA Ground-water Monitoring Activities* (WHC 1995) or equivalent PNNL documents and *Procedures for Groundwater Investigations* (PNL-MA-567).

**Table 3.2. Groundwater Monitoring Constituents for the 216-S-10 Ditch and Pond**

| Contamination Indicator Parameters | |
|---|---|
| PH | Specific Conductance |
| Total Organic Carbon | Total Organic Halides |
| Groundwater Quality Parameters | |
| Chloride | Phenols |
| Iron | Sodium |
| Manganese | Sulfate |
| Drinking Water Parameters | |
| Barium | Gross Beta |
| Cadmium | Nitrate |
| Chromium | Silver |
| Fluoride | Turbidity |
| Gross Alpha | |
| Site-Specific Parameter | |
| Alkalinity | |

Water table elevation data are evaluated at least annually to determine flow direction. The evaluation also determines if the monitoring wells are still appropriately located and in compliance with 40 CFR 265.91(a).

**Reporting**. A report of the results from monitoring conducted at the S-10 Facility is submitted annually in compliance with 40 CFR 265.94(b).

**Quality Assurance.** Overall Quality Assurance requirements are defined in *Pacific Northwest National Laboratory Quality Assurance Manual* (PNL-MA-70) and Article 31 of the Tri-Party Agreement (Ecology 1994). Quality Assurance requirements specific to sampling and analysis are defined in the *Quality Assurance Project Plan for RCRA Ground-water Monitoring Activities* (WHC 1995) or equivalent PNNL documents.

REFERENCES

Bjornstad, B. N., 1984, Suprabasalt Stratigraphy Within and Adjacent to the Reference Repository Location, SD-BWI-DP-039, prepared for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Bjornstad, B. N., 1985, "Late-Cenozoic Stratigraphy and Tectonic Evolution Within a Subsiding Basin, South-Central Washington," Geological Society of America, Abstracts with Programs, Vol. 17, No. 7, p. 524.

Bjornstad, B. N., K. R. Fecht, and A. M. Tallman, 1987, Quaternary Stratigraphy of the Pasco Basin Area, South-Central Washington, RHO-BW-SA-563A, Rockwell Hanford Operations, Richland, Washington.

Bouwer, H., and R. C. Rice, 1976, "A Slug Test for Determining Hydraulic Conductivity of Unconfirmed Aquifers with Completely or Partially Penetrating Wells," Water Resources Research, Vol. 12, No. 3, p. 423-428.

Bretz, J. H., H. T. U. Smith, and G. E. Neff, 1956, "Channel Scabland of Washington: New Data and Interpretations," Geological Society of America Bulletin, Vol. 67, p. 957.

Caggiano, J. A., and D. W. Duncan, eds,. 1983, Preliminary Interpretation of the Tectonic Stability of the Reference Repository Location, Cold Creek Syncline, Hanford Site, RHO-BW-ST-19P, Rockwell Hanford Operations, Richland, Washington.

Coony, F. M., and S. P. Thomas, 1989, Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas, WHC-EP-0141-1, Westinghouse Hanford Company, Richland, Washington.

Cooper, H. H., Jr., and C. E. Jacob, 1946, "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History," American Geophysical Union Transactions, Vol. 27, No. 4, p. 526-534.

Cooper, H. H., Jr., J. D. Bredehoeft, and I. S. Papdopulos, 1967, "Response of a Finite-Diameter Well to an Instantaneous Charge of Water," Water Resources Research, Vol. 3, No. 1, p. 263-269.

DOE, 1987, 216-S-10 Ditch and Pond Preliminary Closure/Post Closure Plan, U.S. Department of Energy, Richland, Washington.

DOE, 1988, Consultation Draft, Site Characterization Plan, Reference Repository Location, Hanford Site, Washington, DOE/RW-0164, Vol. 1, U.S. Department f Energy, Washington, D.C.

Ecology, 1994, Hanford Federal Facility Agreement and Consent Order, Washington State Department of Ecology, U.S. Environmental Protection Agency, and the U.S. Department of Energy, Olympia, Washington.

EPA, 1976, National Interim Primary Drinking Water Regulations, EPA-570/9-76-0003, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document, (TEGD), OSWER-9950.1, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986b, Test Methods for Evaluating Solid Waste, SW-846, U.S. Environmental Protection Agency, Washington, D.C.

ERDA, 1975, Final Environmental Statement, Waste Management Operations, Hanford Reservation, Two Vols., ERDA-1538, U.S. Energy Research and Development Administration, National Technical Information Service, Springfield, Virginia.

Fecht, K. R., S. P. Reidel, and A. M. Tallman, 1985, Paleodrainage of the Columbia River System on the Columbia Plateau of Washington State: A Summary, RHO-BW-SA-318P, Rockwell Hanford Operations, Richland, Washington.

Gee, G. W., 1987, Recharge at the Hanford Site: Status Report, PNL-6403, Pacific Northwest Laboratory, Richland, Washington.

Gephart, R. E., R. C. Arnett, R. G. Baca, L. S. Leonhart, and F. A. Spane, 1979, Hydraulic Studies Within the Columbia Plateau, Washington: An Integration of Current Knowledge, RHO-BWI-ST-5, prepared for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Graham, M. J., M. D. Hall, S. R. Strait, and W. R. Brown, 1981, Hydrology of the Separations Area, RHO-ST-42, prepared for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Graham, M.J., G.V. Last, K.R. Fecht, 1984, An Assessment of Aquifer Intercommunication in the B-Pond-Gable Mountain Pond Area of the Hanford Site, RHO-RE-ST-12P, prepared for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Hodge, C. E., 1990, Generic Specification for Groundwater Monitoring Wells, Rev. 4, WHC-S-014, Westinghouse Hanford Company, Richland, Washington.

Hvorslev, M. J., 1951, "Time Lag and Soil Permeability in Groundwater Observations," U.S. Army Corps Engrs. Waterways Exp. Sta. Bull. 36, Vicksburg, Mississippi.

Jensen, E. J., 1987, An Evaluation of Aquifer Intercommunication Between the Unconfined and Rattlesnake Ridge Aquifers on the Hanford Site, PNL-6313, Pacific Northwest Laboratory, Richland, Washington.

Jungfleisch, F., 1988, Preliminary Evaluation of Hanford Liquid Discharges to Ground, WHC-EP-0052, Westinghouse Hanford Company, Richland, Washington.

Kasza, G. L., and A. L. Schatz, 1989, Groundwater Maps of the Hanford Site Separations Area, January 1989, WHC-EP-0142-2, Westinghouse Hanford Company, Richland, Washington.

Kipp, K. L., and R. D. Mudd, 1973, Collection and Analysis and Pump Test Data for Transmissivity Values, BNWL-1709, prepared for the U.S. Atomic Energy Commission under Contract AT(45-1): 1830 by Battelle, Pacific Northwest Laboratories, Richland, Washington.

Klute, A., and C. Dirksen, 1986, "Hydraulic Conductivity and Diffusivity: Laboratory Methods," in A. Klute ed., Methods of Soil Analysis, Part 1, pp. 687-732, American Society of Agronomy, Madison, Wisconsin.

Last, G. V., and T. L. Liikala, 1987, A Field Guide for Well Site Geologists: Cable Tool Drilling, PNL-6392, Pacific Northwest Laboratory, Richland, Washington.

Last, G. V., B. N. Bjornstad, M. P. Bergeron, D. W. Wallace, D. R. Newcomer, J. A. Schramke, M. A. Chamness, C. S. Cline, S. P. Airhart, and J. S. Wilbur, 1989, Hydrogeology of the 200 Areas Low-Level Burial Grounds-An Interim Report, PNL-6820 Vol. 1, Pacific Northwest Laboratory, Richland, Washington.

Law, A. G., J. A. Serkowski, and A. L. Schatz, 1987, Results of the Separations Area Ground-Water Monitoring Network for 1986, RHO-RE-SR-87-24P, prepared for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Liikala, T. L., D. S. Daly, and A. P. Toste, 1988, An Evaluation of the Effects of Well Construction Materials and Ground-Water Sampling Equipment on Concentrations of Volatile Organic Compounds, PNL-6585, Pacific Northwest Laboratory, Richland, Washington.

Maxfield, H.L., 1979, 200 Areas Waste Sites, RHO-CD-673, Handbook compiled for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Mullineaux, D. R., R. E. Wilcox, W. F. Ebaugh, R. Fryxell, and M. Rubin, 1978, "Age of the Last Major Scabland Flood of Eastern Washington," Quaternary Research, Vol.10, No. 2, p. 171.

Myers, C. W./S. M. Price, J. A. Caggiano, M. P. Cochran, W. J. Czimer, N. J. Davidson, R. C. Edwards, K. R. Fecht, G. E. Holmes, M. G. Jones, J. R. Kunk, R. D. Landon, R. K. Ledgerwood, J. T. Lillie, P. E. Long, T. H. Mitchell, E. H. Price, S. P. Reidel, and A. M. Tallman, 1979, Geologic Studies of the Columbia Plateau: A Status Report, RHO-BWI-ST-4, Rockwell Hanford Operations, Richland, Washington.

Myers, C. W., and S. M. Price, eds., 1981, Subsurface Geology of the Cold Creek Syncline, RHO-BWI-ST-14, Rockwell Hanford Operations, Richland, Washington.

PNL, 1989, Procedures for Ground-Water Investigations, PNL-6894, Pacific Northwest Laboratory, Richland, Washington.

PSPL, 1982, Skagit/Hanford Nuclear Project, Preliminary Safety Analysis Report, Vol. 4, App. 20, Amendment 23, Puget Sound Power and Light Company, Bellevue, Washington.

Reidel, S. P., K. R. Fecht, and R. W. Cross, 1982, "Constraints on Tectonic Models for the Columbia Plateau from the Age and Growth Rates of Yakima Folds," in Proceedings, 33rd Alaska Science Conference, Vol. 12, Arctic Division, American Association for Advancement of Science.

Routson, R. C., M. R. Fuchs, and W. A. Jordan, 1988, Recharge Estimates for the Hanford Site 200 Areas Plateau, WHC-EP-0046, Westinghouse Hanford Company, Richland, Washington.

Schatz, A. L., and M. D. McElroy, 1988, Ground-Water Maps of the Hanford Site Separations Area June 1988, WHC-EP-0142-1, Westinghouse Hanford Company, Richland, Washington.

Serkowski, J. A., A. G. Law, J. J. Ammerman, and A. L. Schatz, 1988, Results of Ground-Water Monitoring for Radionuclides in the Separations Area-1987, WHC-EP-0152, Westinghouse Hanford Company, Richland, Washington.

Stanley, T. W., and S. S. Verner, 1983, QAMS-005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Plans, EPA-600/4-83-004, U. S. Environmental Protection Agency, Washington, D.C.

Stone, W. A., J. M. Thorp, O. P. Gifford, and D. J. Hoitink, 1983, Climatological Summary for the Hanford Area, PNL-4622, Pacific Northwest Laboratory, Richland, Washington.

Supply System, 1981, Final Safety Analysis Report, WPPSS Nuclear Project No. 2, Amendment 18, Washington Public Power Supply System, Richland, Washington.

Swanson, D. A., T. L. Wright, P. R. Hooper, and R. D. Bentley, 1979, Revisions in Stratigraphic Nomenclature of the Columbia River Basalt Group, Bulletin 1457-G, U.S. Geological Survey, Washington, D.C.

Tallman, A. M., K. R. Fecht, M. C. Marratt, and G. V. Last, 1979, Geology of the Separation Areas, Hanford Site, South-Central Washington, RHO-ST-23, prepared for the U.S. Department of Energy by Rockwell Hanford Operations, Richland, Washington.

Theis, C. V., 1935, "The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Ground-Water Storage," American Geophysical Union Transactions, Vol. 16, p. 519.

Wallace, R. W., 1977, A Comparison of Evapotranspiration Estimates Using ERDA Hanford Climatological Data, PNL-2698, Pacific Northwest Laboratory, Richland, Washington.

WHC, 1988, Environmental Investigations and Site Characterization Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, Borehole Completion Data Package for the 216-S-10 Ditch and Pond, WHC-MR-0206, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, Generic Specification for Groundwater Monitoring Wells, Rev. 6, WHC-S-014, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, Borehole Completion Data Package for DOE for the 216-S-10 Ditch and Pond CY 1991, WHC-SD-EN-DP-045, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, Borehole Completion Data Package for the 216-S-10 Ditch and Pond CY 1992, WHC-SD-EN-DP-052, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995, Quality Assurance Project Plan for RCRA Groundwater Monitoring Activities, WHC-SD-EN-QAPP-001, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

CONTROLLED COPY # 2

*INTERIM CHANGE NOTICE*
*(ICN)*

ICN–WHC-SD-EN-AP-015.1 R0


*A.*
**Document Number:** WHC-SD-EN-AP-015 **Revision Number:** 0

**Document Title:** Revised Ground-Water Monitoring Plan for the 200 Areas Low-Level Burial Grounds

**Document's Original Author:** G. V. Last and B. N. Bjornstad

**Effective Date of ICN:** 7/20/98

**Change Requested by:**
R. B. Mercer
RB Mercer 7/20/98

*B.* **Action:** Lineout section 3.3.6 in the original document and page 12 of 13 of ECN 618177 (the monitoring well table), write-in the ICN number in the margins, and initial and date near these changes.
Add to section 3.6 the ICN number in the margin, and initial and date near the change.
Attach this ICN to the front of the document.

*C.* **Effect of Change:** Change will modify the monitoring network for Low-Level Waste Management Area 4 (LLWMA-4) to reflect current groundwater flow conditions.

*D.* **Reason for Change/Description of Change:**

**Reason:** The groundwater flow direction at LLWMA-4 has changed as a result of declining water levels and the influence of the 200-ZP-1 pump and treat operations.

**Description:** This ICN redefines the upgradient/downgradient status of the groundwater monitoring well at LLWMA-4 and presents the statistical approach for re-determining the upgradient/downgradient comparison values.

*E.* **Approval Signatures:**
**(Please sign and date)**

**Type of Change: (Check one):**
_ Minor X Major

Process
Quality Department: T L Almeida Date: 7/20/98

Approval Authority: [signature] Date: 7/17/98

Other Approvals: _____ Date: / /

3.3.6 Revised Monitoring System for Waste Management Area 4

Seventeen groundwater monitoring wells were installed to monitor Low-Level Waste Management Area 4 (LLWMA-4). A summary of information for each well is in the attached table. This table lists well location, depth drilled, screened interval, and the current position in relation to the current groundwater flow direction.

3.3.6.1 Shallow Upgradient Wells

Four RCRA compliant wells have been selected on the basis of location and representative chemistry to be the upgradient monitoring wells for LLWMA-4. These are 299-W15-15, 299-W18-21, 299-W18-23, and 299-W18-26. These wells are completed in the upper portion of the unconfined aquifer.

3.3.6.2 Shallow Downgradient Wells

Three RCRA compliant wells will be used to monitor the upper portion of the unconfined aquifer downgradient from LLWMA-4. These are 299-W15-16, 299-W15-18, and 299-W18-24.

3.3.6.3 Deep Monitoring Wells

Two RCRA compliant wells (299-W15-17 and 299-W18-22) will continue to be used as monitoring wells for the deeper portion of the unconfined aquifer.

Low-Level Waste Management Area 4
Groundwater Monitoring Wells

| Well Number | Coordinates | | Elevation (ft above msl) | | Depth (ft below gs) | |
|---|---|---|---|---|---|---|
| | Plant | Lambert | Brass Cap | Top of Casing | Drilled | Screened Interval |
| 299-W15-15[87] | N 40,330<br>W 78,103 | N 135,751.88<br>E 566,088.99 | 695.74 | 697.96 | 255 | 223-253 |
| 299-W15-16[87] | N 40,269<br>W 77,387 | N 135,733.84<br>E 566,307.24 | 682.62 | 684.89 | 244 | 208-238 |
| 299-W15-17[87d] | N 40,221<br>W 77,387 | N 135,719.21<br>E 566,307.28 | 682.85 | 684.64 | 450 | 423-433 |
| 299-W15-18[87] | N 39,705<br>W 77,383 | N 135,561.96<br>E 566,308.89 | 683.55 | 385.71 | 243 | 208-238 |
| 299-W15-19[89]<br>Dry | N 41,041.4<br>W 77,771.8 | N 135,968.95<br>E 566,189.38 | 688.48 | 691.60 | 246 | 214-235 |
| 299-W15-20[89]<br>Dry | N 41,027.5<br>W 78,120.2 | N 135,964.5<br>E 566,083.2 | 695.43 | 698.36 | 245 | 220-241 |
| 299-W15-23[90]<br>Dry | N 40,679.6<br>W 78,118.7 | N 135,858.39<br>E 566,083.98 | 696.26 | 699.49 | 242 | 219-239 |
| 299-W15-24[89]<br>Dry | N 39,851.3<br>W 78,096.1 | N 135,606.0<br>E 566,091.4 | 696.25 | 699.37 | 242 | 220-241 |
| 299-W18-21[87] | N 37,794<br>W 78,080 | N 134,979.04<br>E 566,097.93 | 666.50 | 668.62 | 227 | 196-226 |
| 299-W18-22[87d] | N 37,831<br>W 78,109 | N 134,990.30<br>E 566,089.06 | 666.49 | 668.49 | 455 | 417-448 |
| 299-W18-23[87] | N 38,987<br>W 78,120 | N 135,342.58<br>E 566,084.83 | 694.75 | 696.81 | 255 | 220-251 |
| 299-W18-24[87] | N 38,998<br>W 77,180 | N 135,346.65<br>E 566,371.29 | 682.18 | 684.35 | 240 | 206-236 |
| 299-W18-26[89] | N 39,477.1<br>W 78,096.6 | N 135,492.0<br>E 566,091.6 | 696.03 | 699.05 | 250 | 222-243 |
| 299-W18-27[91] | N 38,607<br>W 78,103 | N 135,226.8<br>E 566,090.5 | 686.78 | 690.25 | 239 | 217-238 |
| 299-W18-28[91] | N 38,214<br>W 78,096 | N 135,107.1<br>E 566,092.9 | 676.51 | 679.99 | 230 | 208-229 |
| 299-W18-29[91p]<br>Dry | N 37,952<br>W 76,560 | N 135,028.4<br>E 566,561.2 | 670.65 | 674.14 | 150 | 119-135 |
| 299-W18-32[92]<br>Dry | N 37,780.4<br>W 76,708.7 | N 134,975.94<br>E 566,515.88 | 673.75 | 676.65 | 225 | 202-222 |

Superscript following well number denotes the year of installation.
Shading denotes upgradient wells.
[d] Deep Well.
[p] Well monitors perched zone.

3.6 Statistical Analysis of Groundwater Monitoring Data

Changing groundwater flow patterns at LLWMA-4 require the re-establishment of the upgradient/downgradient comparison values for the statistical evaluation of the effects of LLWMA-4 on the groundwater chemistry. Under normal conditions quarterly sampling for the contamination indicator parameters would begin as soon as possible after the change in flow direction was determined. In this case quarterly sampling and the statistical evaluation will be delayed until the groundwater regime has stabilized. The effects of the 200-ZP-1 pump and treat activities are impacting the area around LLWMA-4 by extracting groundwater from six wells to the east, removing volatile organic contaminants, and injecting the treated water in any one of four wells to the west of LLWMA-4. The groundwater monitoring network for LLWMA-4 will be monitored semiannually until the flow pattern and chemistry stabilize at which time quarterly analyses for the indicator parameters will begin. At this time it is not clear when stabilization will occur.

# *INTERIM CHANGE NOTICE (ICN)*

ICN–WHC-SD-EN-AP-015.2 R0


*A.*

**Document Number:** WHC-SD-EN-AP-015 **Revision Number:** 0

**Document Title:** Revised Ground-Water Monitoring Plan for the 200 Areas Low-Level Burial Grounds

**Document's Original Author:** G. V. Last and B. N. Bjornstad

**Effective Date of ICN:** 7/20/98

**Change Requested by:**
R. B. Mercer
RB Mercer 7/20/98

*B.* **Action:** Lineout section 3.3.4 in the original document and page 10 of 13 of ECN 618177 (the monitoring well table), write-in the ICN number in the margins, and initial and date near these changes.

Attach this ICN to the front of the document.

*C.* **Effect of Change:** Change will modify the monitoring network for Low-Level Waste Management Area 2 (LLWMA-2) to reflect current groundwater flow conditions.

*D.* **Reason for Change/Description of Change:**

**Reason:** The groundwater flow direction at LLWMA-2 has changed slightly as a result of declining water levels and the resultant exposure of more basalt above the water table in the northeastern portion of this facility.

**Description:** Well 299-E34-7 is now listed as an upgradient monitoring well.

*E.* **Approval Signatures:**
**(Please sign and date)**

**Type of Change: (Check one):**

_ Minor X Major

**Process Quality Department:** T K Almeida **Date:** 7/20/98

**Approval Authority:** [signature] **Date:** 7/17/98

**Other Approvals:** _____ **Date:** / /

3.3.4 Revised Monitoring System for Waste Management Area 2

Sixteen groundwater monitoring wells were installed to monitor Low-Level Waste Management Area 2 (LLWMA-2). A summary of information for each well is in the attached table. This table lists well location, depth drilled, screened interval, and position in relation to the current groundwater flow direction.

3.3.4.1 Upgradient Wells

Upgradient wells for LLWMA-2 are located north and east of the waste management area. A declining water level and basalt high have caused two of the upgradient monitoring wells to go dry since installation (299-W34-4, completed at the top of the basalt, did not encounter groundwater). Well 299-W34-5 located on the north is listed as an upgradient well because of the potential to intercept any runoff from the basalt high. The three remaining wells provide adequate coverage to detect upgradient sources of contamination in the aquifer.

3.3.4.2 Downgradient Wells

Nine downgradient monitoring wells are located south and west of LLWMA-2.

Low-Level Waste Management Area 2
Groundwater Monitoring Wells

| Well Number | Coordinates | | Elevation (ft above msl) | | Depth (ft below gs) | |
|---|---|---|---|---|---|---|
| | Plant | Lambert | Brass Cap | Top of Casing | Drilled | Screened Interval |
| 299-E27-8[87] | N 44,496<br>W 49,642 | N 137,044.54<br>E 574,759.37 | 634.64 | 637.83 | 257 | 226-246 |
| 299-E27-9[87] | N 44,484<br>W 49,122 | N 137,041.34<br>E 574,917.86 | 627.31 | 629.21 | 245 | 220-239 |
| 299-E27-10[87] | N 44,520<br>W 48,522 | N 137,052.82<br>E 575,100.68 | 622.42 | 624.47 | 240 | 212-232 |
| 299-E27-11[89] | N 44,557.6<br>W 49,990.3 | N 137,063.2<br>E 574,653.2 | 640.34 | 643.29 | 265 | 230-251 |
| 299-E27-17[91] | N 44,752.1<br>W 50,337.1 | N 137,122.01<br>E 574,547.31 | 631.75 | 634.72 | 246 | 223-244 |
| 299-E34-2[87] | N 45,076<br>W 50,048 | N 137,220.96<br>E 574,635.13 | 629.03 | 630.80 | 242 | 220-240 |
| 299-E34-3[87] | N 45,337<br>W 48,488 | N 137,301.85<br>E 575,110.34 | 609.48 | 611.52 | 214 | 193-213 |
| 299-E34-4[87]<br>Dry | N 46,791<br>W 49,419 | N 137,744.17<br>E 574,825.35 | 585.17 | 587.56 | 177 | 157-177 |
| 299-E34-5[87] | N 46,791<br>W 50,014 | N 137,743.66<br>E 574,644.02 | 589.01 | 590.79 | 192 | 171-191 |
| 299-E34-6[87]<br>Dry | N 46,784<br>W 50,609 | N 137,741.01<br>E 574,462.69 | 596.83 | 597.83 | 195 | 175-195 |
| 299-E34-7[89] | N 45,519.7<br>W 47,949.3 | N 437,358.0<br>E 575,274.4 | 601.14 | 604.25 | 206 | 194-205 |
| 299-E34-9[91] | N 45,765.4<br>W 51,519.8 | N 137,429.82<br>E 574,186.02 | 625.97 | 628.69 | 234 | 213-234 |
| 299-E34-10[91] | N 45,091.0<br>W 51,198.8 | N 137,224.57<br>E 574,284.40 | 637.01 | 639.77 | 249 | 225-246 |
| 299-E34-11[92] | N 46,264.2<br>W 51,550.7 | N 137,581.78<br>E 574,176.16 | 614.79 | 617.95 | 219 | 208-218 |
| 299-E34-12[92] | N 44,907.0<br>W 50,783.0 | N 137,168.80<br>E 574,411.31 | 635.86 | 638.83 | 248 | 234-245 |
| 299-E35-1[89]<br>Dry | N 45,869.8<br>W 47,339.4 | N 137,465.2<br>E 575,460.0 | 595.25 | 598.30 | 194 | 181-192 |

Superscript following well number denotes the year of installation.
Shading denotes upgradient wells.

# *INTERIM CHANGE NOTICE*
# *(ICN)*



***A.***
**Document Number:** WHC-SD-EN-AP-013 **Revision Number:** 1
**Document Title:** Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond

**Document's Original Author:** M. D. Sweeney

**Effective Date of ICN:** 12/10/98

**Change Requested by:** D.B. Barnett

***B.*** **Action:** Make pen-and-ink changes to the Groundwater Monitoring Plan document, as described below in Section D. Attach this ICN to the front of the document.

***C.*** **Effect of Change:** The groundwater monitoring well network and sampling/analysis procedures are changed according to the description in the attached, revised sections. The frequency of sampling is changed from quarterly to semiannual. This ICN supercedes ICN No. WHC-SD-EN-AP-013.1 R1 dated 01/08/98.

***D.*** **Reason for Change/Description of Change:** Reason: The Assessment Report for 216-B-3 Pond System (Barnett and Teel, 1997) recommends returning this facility to detection-level (contamination-indicator-evaluation) status for groundwater monitoring. Sample frequency is returned to semiannual. Additionally, several wells in the groundwater monitoring network have become dry or will soon be dry. Hence, a revision of the well network, including one proposed new well, is necessary to ensure a continuation of adequate groundwater monitoring at the facility. The constituents list is amended to incorporate all required parameters for RCRA interim-status, detection-level monitoring.

Description of Change: The constituent list, as illustrated in table 11 (p. 56) of the document, is changed to list Contamination Indicator Parameters (TOC, TOX, pH, and Conductivity), gross-alpha, and gross beta analyses on a semiannual basis and water-quality parameters (anions, phenols, ICP metals [filtered]) on an annual basis. Mark through semi-volatile organic compounds, and alkalinity with a single line. Write in phenols analyses (annual). Sections 3.4.2 and 3.4.3 (p. 46) are combined and amended to read as in the attached new section 3.4.2. Mark through Sections 3.4.2 and 3.4.3 with a single line and refer to the attached new Section 3.4.2. Mark through Section 3.4.4 and refer to the attached new Section 3.4.4. Section 3.6.2 is amended to substitute the attached portion of 3.6.2 for the first paragraph of the section in the document. Mark through the first paragraph of Section 3.6.2. and refer to the attached new first paragraph of Section 3.6.2. Delete Table 9, p. 47-48. Add "additional reference" to the reference list. Initial and date all changes to the original document.

Reference: Barnett, D. B., S. S. Teel, 1997, Results of RCRA Groundwater Quality Assessment at the 216-B-3 Pond Facility, PNNL-11604, Pacific Northwest National Laboratory, Richland, Washington.

***E.*** **Approval Signatures:**
**(Please sign and date)**

**Type of Change: (Check one):**

___ **Minor** X **Major**

**Process**
**Quality Department:** T.L. Almeida T L Almeida **Date:** 12/14/99

**Approval Authority:** R.M. Smith/S.P. Luttrell **Date:** 12/18/98

**Other Approvals:** D. B. Barnett (Technical) **Date:** 12/10/98

:M. J. Hartman (Technical Review) Mary J Hartman **Date:** 12/21/98

### 3.4.2 FY 1999 Changes to the Interim-Status Groundwater Monitoring Well Network

Rapidly-declining heads in the aquifer beneath the B Pond System, changes in regulatory status of the three expansion ponds, reevaluation of site hydrogeology, and the conceptual model for the distribution of contamination potential beneath the facility require adjustments to the groundwater monitoring well network.

#### Background

The discontinuation of wastewater disposal to the B Pond System in the mid 1990's has caused dramatic declines in the hydraulic head in the aquifer beneath the facility and a consequent decline in water levels in monitoring wells. Several wells in the network are going dry, or predicted to be dry in the near future. Wells that are currently considered dry are 699-43-43, 699-44-43B, 699-44-42, 699-43-42J, 699-43-40, 699-43-41E, and 699-42-41 (Figures 3 and 3.1).

Until late 1994, the expansion ponds 3A, 3B, and 3C were considered part of the regulated B Pond facility along with the main pond and a nearby segment of the B-3-3 ditch (Figure 3.1). In late 1994, these three expansion ponds were clean closed and thus severed from the regulatory requirements of the B Pond System. Several of the groundwater monitoring wells in the B Pond network were originally drilled in anticipation of continued monitoring of the expansion ponds, and continued in use in spite of the clean closure of the expansion ponds. Three wells emplaced to monitor groundwater at the 200 Area TEDF (Figure 3) were initially included in the B Pond network to establish background values for the TEDF until that facillity became operational in 1995. All wells historically used in the B Pond Network are shown in Figure 3. Many of the expansion pond wells and wells around the TEDF are screened below the Ringold Formation lower mud unit (at the top of the uppermost aquifer). The presence of this stratigraphic feature and its effect of diverting infiltrating effluent, implies that the expansion pond wells monitor groundwater emanating from the hydraulic mound (Figure 3.2), north of the 3B pond, instead of effluent that infiltrated immediately beneath the expansion ponds (i.e., the 3C Pond). This translocation of infiltration is an important aspect of interpreting the potential for contaminant transport at the B Pond System, and was not generally recognized during the earliest years of groundwater monitoring at the facility. Evidence for this circumstance is seen as the widespread occurrence of the lower mud unit, except in the northern portions of the facility (where the apex of the mound occurs), and the fact that the location of the apex of the hydraulic mound has changed little since groundwater monitoring began at the facility. The location of the mound has remained consistent despite changes in discharge locations (from the main/3A ponds to the 3C pond).

#### Potential Contamination Sources in Groundwater

Because the three B Pond expansion ponds were clean closed in 1994, these are no longer considered sources of contamination or subject to regulation. In fact, the 3C expansion pond received clean water (effluent) from mid 1994 until August 1997 without the requirement of a discharge permit. This stream was subsequently diverted to the 200 Area TEDF in 1997. However, several of the monitoring wells adjacent to the expansion ponds are still useful for groundwater monitoring at the facility. One potential avenue for contamination migration that may be effectively detected by wells around the expansion ponds is that which could be still entrained in groundwater emanating from the apex of the mound. This water may have been in

transit for several years, and thus may potentially contain contamination from the latter years of operation of the main pond. Other species, with higher coefficients of distribution, may be present because of retardation in movement compared with average groundwater velocity. Groundwater travel times for the Ringold Formation in the B Pond area have been estimated as low as 0.009 m/day. Such a low average flow velocity would suggest that effluent from early years of operation could still be in the vicinity of the B Pond facility. Wells situated on the limbs of the mound (downgradient of the mound apex) may be capable of detecting this type of contamination. Additionally, the voluminous discharges associated with earlier years of facility operation, when the highest probability existed for contamination in the waste stream, probably provided a higher hydraulic head that could have forced potential contamination deeper into the aquifer. Such deeper contamination is evident by the distribution of tritium in deep/shallow well pairs at the facility (see Barnett and Chou 1998). Hence, deeper well completions are needed to detect contamination from this source.

The second potential source of groundwater contamination lies within the sediments of the vadose zone and aquifer beneath the main pond and the adjoining portion of the B-3-3 ditch (Figure 3.1). Groundwater movement beneath the main pond and B-3-3 ditch is generally northeast to southwest, away from the center of the decaying hydraulic mound (Figure 3.2). Thus, potential contamination residing in the vadose zone or aquifer sediments beneath the main pond could be mobilized in a direction southwest of the main pond. For this reason, some monitoring wells should be located hydraulically downgradient of this potential source.

### Revised Monitoring Well Network

The existing array of wells around the B Pond System provide more than an adequate number of potential monitoring points from which to select. The possible exception is the area immediately southwest of the B Pond, for which a new well is proposed. The revised well network is shown in Figure 3.1. In all, 9 wells (8 downgradient) are proposed for the revised network.

Of the existing wells, those selected to address potential contamination entrained in groundwater emanating from the hydraulic mound apex include wells 699-43-41G, 699-44-39B, 699-40-39, 699-41-42, and 699-42-42B. Selection of these wells is based on uniform areal distribution around the facility (or groundwater mound), depth of the wells (deeper wells are preferred because of the greater potential for intercepting contamination), projected life of the wells as the mound dissipates, and probable transport times of potential contaminants originating from the facility.

Wells that will monitor groundwater for potential contaminants originating in the vadose zone or aquifer sediments beneath the main pond and adjoining B-3-3 ditch, in addition to potential contamination entrained in groundwater, are wells 699-42-42B, 699-43-45, 299-E26-11, and a new proposed well southwest of the main pond..

A comparison of these well locations with the June 1998 potentiometric surface is shown in Figure 3.2. Well 299-E32-4, in the northwest portion of the 200 East Area, will remain as the upgradient monitoring location.

### 3.4.4. Proposed RCRA Monitoring Well

The potential sources of groundwater contamination from the facility and groundwater flow directions (see discussion in Section 3.4.2), indicate that additional monitoring coverage is needed immediately southwest of the main pond. Hence, a RCRA-compliant, downgradient well is proposed for the location shown in Figure 3.1. The well will be screened over an extended interval to accommodate rapidly falling water levels and lengthen the service life of the well, and to intercept contamination at different levels in the aquifer. The well will be drilled to basalt (base of the uppermost aquifer) and screened below the water table. Upon completion, the well will be sampled for the Appendix IX list of constituents, and thereafter for the list of parameters shown in Table 11.

### 3.6.2 Sample Frequency and Analytical Procedures

Samples will be collected from all wells in the groundwater monitoring well network on a semiannual basis, in accordance with detection monitoring described in 40 CFR 265.92 and WAC 173-303. Constituents for which groundwater samples will be analyzed are those ljsted in revised Table 11.

### Additional Reference

Barnett, D. B., C. J. Chou, 1998, Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility, PNNL-11903, Pacific Northwest National Laboratory, Richland, Washington.

# Distribution

Pacific Northwest National Laboratory

| | |
|---|---|
| D. B. Barnett | K6-81 |
| C. J. Chou | K6-81 |
| M. J. Hartman | K6-96 |
| S. P. Luttrell | K6-96 |
| R. M. Smith | K6-96 |
| M. D. Sweeney | K6-81 |

Bechtel Hanford, Inc.

| | |
|---|---|
| J. V. Borghese | H0-19 |

DOE Richland Operations Office

| | |
|---|---|
| M. J. Furman | H0-12 |

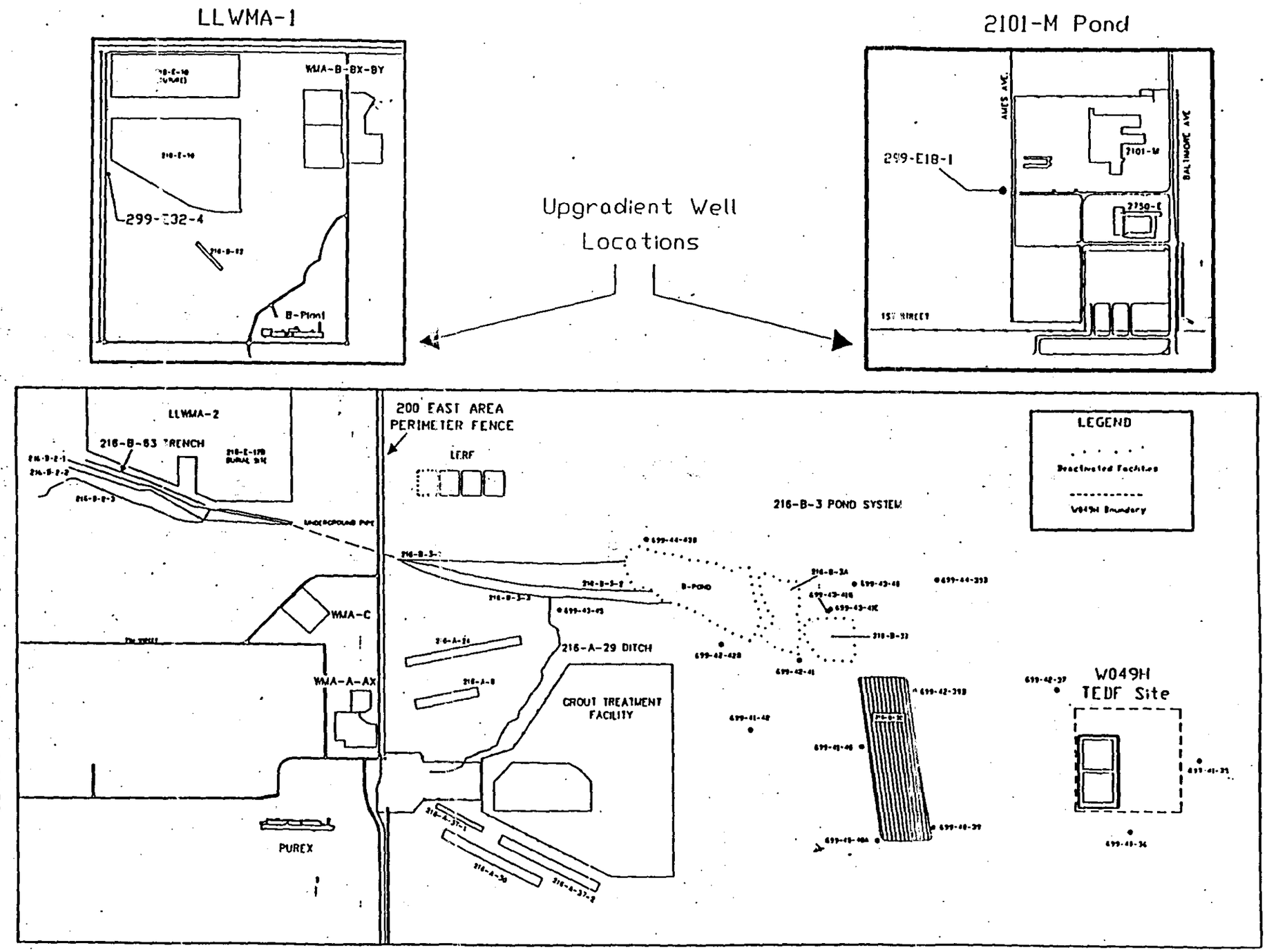



Figure 3. Map of 216-B-3 Pond Site Showing Ponds and Wells.

RCRA/DBB/ENAP013 Rev 1

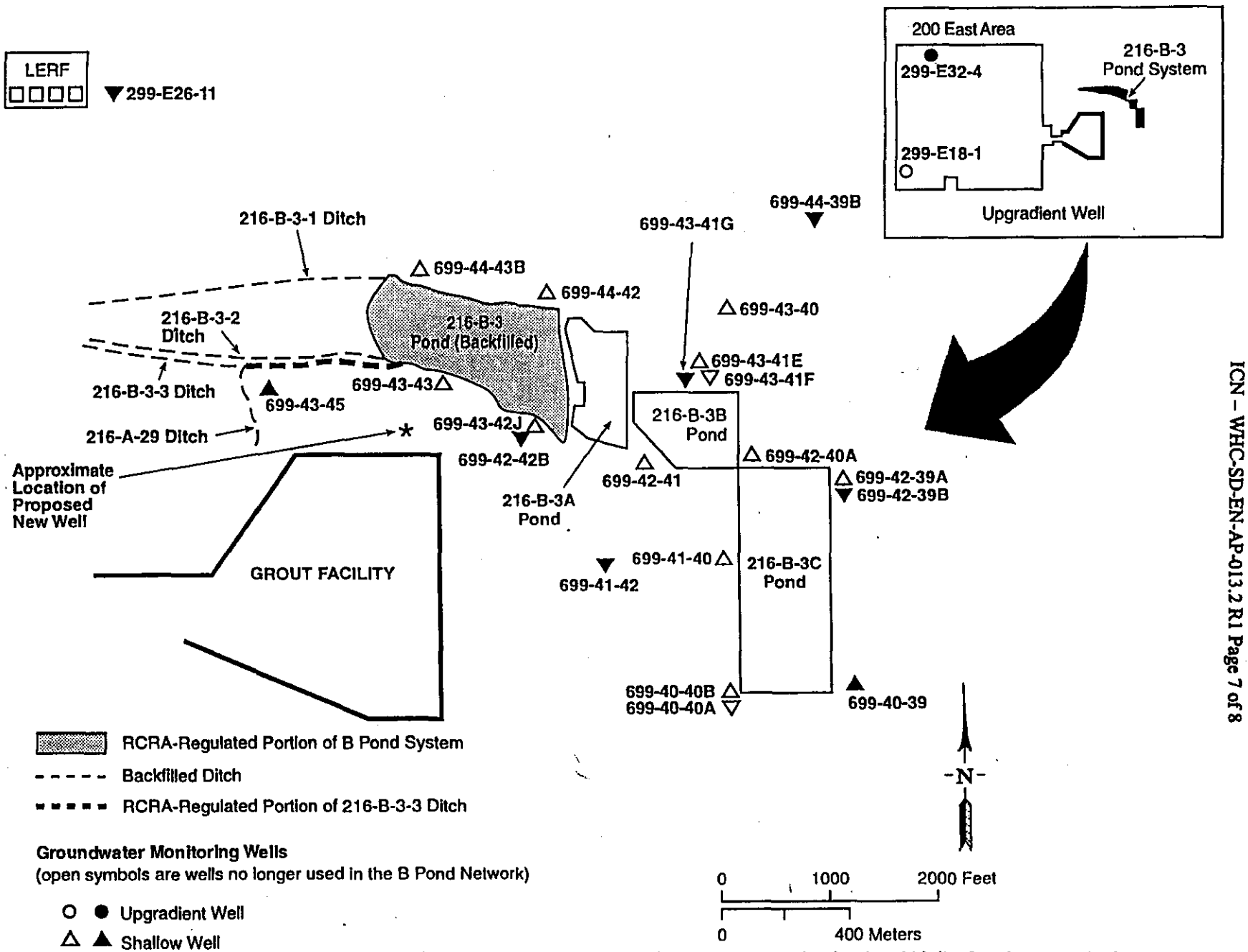



**Figure 3.1.** Facility Layout and Locations of Monitoring Wells for the 216-B-3 Pond System.

RP98110188.1

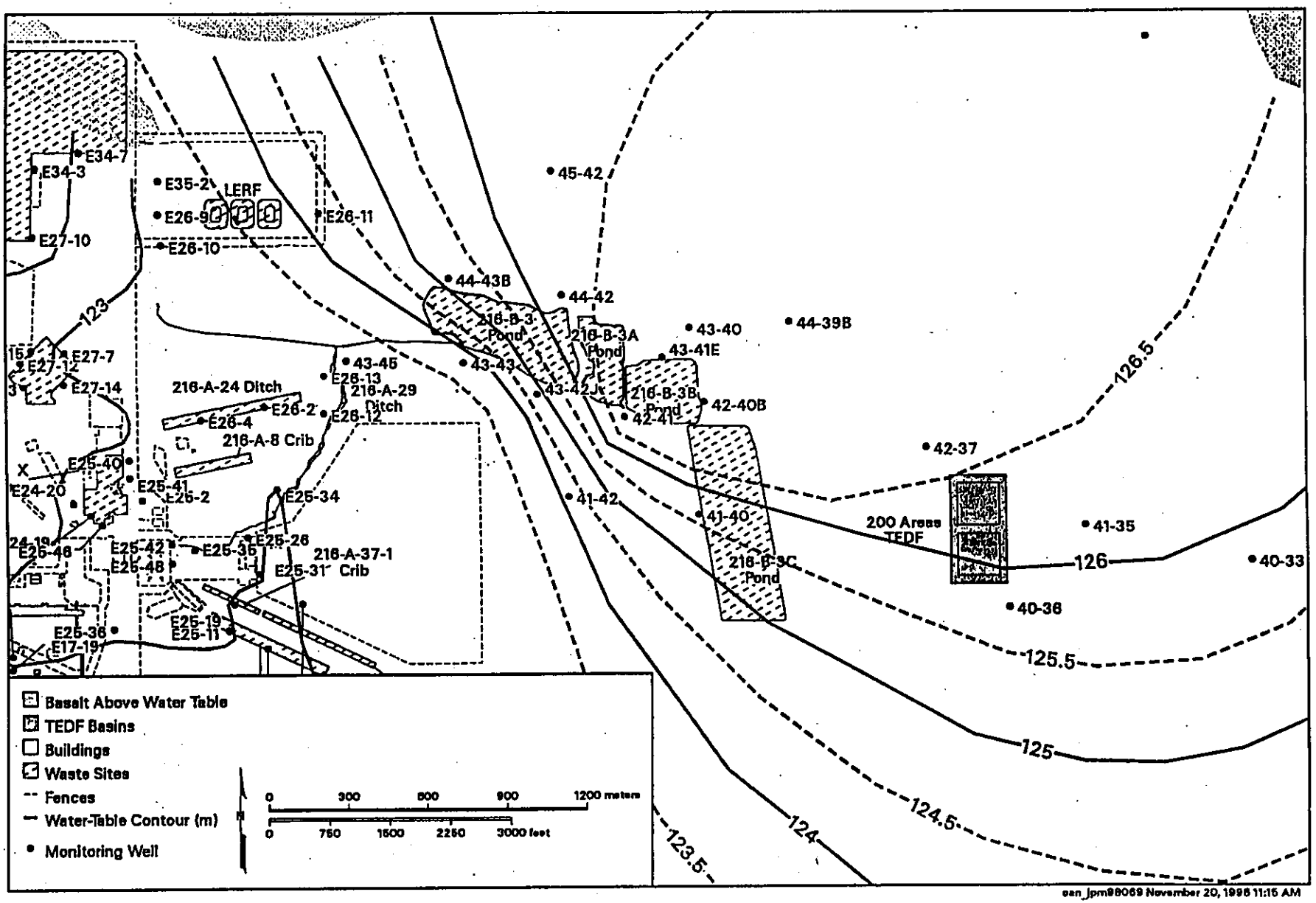



Figure 3.2. Water Table Map for the B Pond Area, June 1998.

# INTERIM CHANGE NOTICE (ICN)

ICN - WHC-SD-EN-AP-012.1 R1
Page 1 of 3

**A.**
**Document Number:** WHC-SD-EN-AP-012 **Revision Number:** 1

**Document Title:** Interim Status Groundwater Monitoring Plan for the Single-Shell Tanks

**Document's Original Author:** J.A. Caggiano and S.M. Goodwin

**Effective Date of ICN:** 6/2/98

**Change Requested by:** Mary Hartman

**B. Action:**
Attach this ICN and attachments to the front of the document.

**C. Effect of Change:**
The new section describes well locations, depth, drilling, and completion for 9 new wells that are required to replace dry wells or to supplement assessment programs. Personnel affected by the change include RCRA project scientists and sampling scheduler.

**D. Reason for Change/Description of Change:**

**Reason:** New wells are required for Waste Management Areas (WMAs) B-BX-BY, T, TX-TY, and U to replace wells that are going dry or to supplement assessment networks. This groundwater monitoring plan will be replaced with separate plans for each WMA later this year, but the plans will not be completed before drilling starts. This ICN will be used to document the planned well drilling and installation.

**Description:** See new section 3.6 and table 3.6-1 (attached).

**E. Approval Signatures:**
**(Please sign and date)**

**Type of Change: (Check one):**

_ Minor X Major

**Process Quality Department:** T.L. Almeida T L Almeida **Date:** 4/21/98

**Approval Authority:** R.M. Smith/S.P. Luttrell [signature] **Date:** 6/2/98

**Other Approvals:** S.M. Narbutovskih "M Hartman for SM N." F.N. Hodges F.N. Hodges M.J. Hartman Mary J Hartman

3.6 Installation of Wells in 1998

Nine new monitoring wells will be installed in 1998: two for WMA T, four for WMA TX-TY, two for WMA U, and one for WMA BX-BY. Well locations were based on the following criteria: (1) the need to replace key wells going dry, and (2) support detection or assessment monitoring. For wells going dry at WMAs in assessment, new wells are located as close as possible to the dry wells to maintain data continuity.

Well drilling and construction design specifications will be provided to the drilling contractor via a Description of Work. The wells will be drilled using air rotary or cable tool techniques following the contractor's procedures. The wells will be constructed as "resource protection wells" as defined in WAC 173-160, and will be equipped with surface well head protection, locking caps, and dedicated sampling pumps. The completed wells will be developed to settle the filter packs around the screens and clean up the remnants of drilling.

Six of the wells (B8545, -48, -49, -50, -51, and -53) will be drilled to ~35 ft below the water table, within unit E of the Ringold Formation. Wells B8546 and -47 will be drilled to the bottom of the unconfined aquifer for depth-discrete groundwater sampling. Water samples in these two boreholes will be collected at approximately 50, 100, 150, 190, and 200 ft below the water table to help determine how contaminants are distributed vertically in the aquifer. These samples will be analyzed for anions, metals, alkalinity, volatile organics, tritium, technetium-99, and a gamma scan. After drilling, sampling, and geophysical logging, the boreholes will be backfilled to within 35 ft below the water table. The wells will be constructed to monitor the top 35 ft of the unconfined aquifer. Longer screens than in the existing wells will be used to extend the wells' useful lives as the water table continues to drop in the 200 Areas.

The unconfined aquifer beneath WMA B-BX-BY is thin (~11-12 ft), and is underlain by the Elephant Mountain basalt. Well B87554 will be drilled into the basalt ~4 ft and will be constructed to monitor the entire thickness of the unconfined aquifer.

During drilling grab samples will be collected every 5 to 10 ft of depth and at changes in lithology as determined by the site geologist. These samples will be used for lithologic descriptions, sieve analyses, and radiation release, and will be archived for potential future use. Additional geologic samples will be collected as listed in Table 3.6-1. Soil data will provide hydrogeologic parameters and soil reaction data to improve the conceptual models of the WMAs.

Geophysical logging (spectral gamma and neutron moisture) will be performed in eight of the wells (see Table 3.6-1) before downsizing the temporary casing strings and at total depth. Results will aid stratigraphic correlation, identify gamma-emitting radionuclides, and provide a continuous moisture profile of the vadose zone. Aquifer testing, either a slug test or pumping test, may be performed after completion of the wells to help estimate hydraulic conductivity of the aquifer.

The new wells will follow the same sampling and analysis schedules as the rest of the monitoring networks for the WMAs.

Table 3.6-1. Drilling and Construction Information for FY 1998 Wells at the Single-Shell Tanks.

| Well | WMA | Approx. Lambert coordinates, m | Estimated Depth, ft | Screen length, ft | Geologic samples[a] | Other tests |
|---|---|---|---|---|---|---|
| B8545 | T | N566820<br>W136803 | 260 ±5 | 35 | Hanford coarse and fine (~25, ~60 ft depth) for sieve analysis. Split-spoon at Hanford/Plio-Pleistocene contact (~70 ft depth) and sandy silt of Plio-Pleistocene (~85 ft depth). | Geophysical logs (spectral gamma and neutron).. |
| B8546 | T | N566897<br>W136794 | 435 ±10 | 35[b] | Hanford coarse and fine (~25, ~60 ft depth) for sieve analysis. Split-spoon at Hanford/Plio-Pleistocene contact (~82 ft depth) and sandy silt of Plio-Pleistocene (~90 ft depth). | Water samples 50, 100, 150, 190, and 200 ft below water table. Geophysical logs (spectral gamma and neutron). |
| B8547 | TX-TY | N566800<br>W136491 | 435 ±10 | 35[b] | Hanford coarse and fine (~25, ~70 ft depth) for sieve analysis. Split-spoon at Hanford/Plio-Pleistocene contact (~87 ft depth) and sandy silt of Plio-Pleistocene (~92 ft depth). | Water samples 50, 100, 150, 190, and 200 ft below water table. Geophysical logs (spectral gamma and neutron). |
| B8548 | TX-TY | N566846<br>W136409 | 255 ±5 | 35 | Hanford coarse and fine (~25, ~70 ft depth) for sieve analysis. | Geophysical logs (spectral gamma and neutron). |
| B8549 | TX-TY | N566904<br>W136266 | 255 ±5 | 35 | Hanford coarse and fine (~25, ~70 ft depth) for sieve analysis. | Geophysical logs (spectral gamma and neutron).. |
| B8550 | TX-TY | N566671<br>W136192 | 255 ±5 | 35 | Vadose samples to be analyzed for calcium carbonate and moisture. Hanford coarse and fine (~25, ~70 ft depth) for sieve analysis. Split-spoon at Hanford/Plio-Pleistocene contact (~96 ft depth) and sandy silt of Plio-Pleistocene (~105 ft depth). | Geophysical logs (spectral gamma and neutron). |
| B8551 | U | N566896<br>W135018 | 260 ±5 | 35 | Hanford coarse and fine (~30, ~70 ft depth) for sieve analysis. | None. |
| B8553 | U | N566824<br>W134950 | 260 ±5 | 35 | Vadose samples to be analyzed for calcium carbonate and moisture. Hanford coarse and fine (~30, ~70 ft depth) for sieve analysis. Split-spoon in sandy silt of Plio-Pleistocene (~130 ft depth). | Geophysical logs (spectral gamma and neutron). |
| B8554 | B-BX-BY | N573703<br>W137479 | 265 ±5 | 10 or as required | Vadose samples to be analyzed for calcium carbonate and moisture. Major Hanford units for sieve analysis. Split-spoon in sandy silt/mud unit, if present (~216 ft, ~225 ft). | Geophysical logs (spectral gamma and neutron). |

(a) grab samples taken in vadose and saturated zones every 5 to 10 ft and at changes in lithology, as determined by the site geologist for lithologic description and radiation release. Additional samples in vadose zone as noted.

(b) Boreholes will be drilled to bottom of unconfined aquifer for sampling, then backfilled before completion.

# Distribution

**Pacific Northwest National Laboratory**

| | |
|---|---|
| M.J. Hartman | K6-96 |
| F.N. Hodges | K6-81 |
| V.G. Johnson | K6-96 |
| S.M. Narbutovskih | K6-96 |
| B.A. Williams | K6-81 |
| D. Vela (file) | |

# *INTERIM CHANGE NOTICE*
## *(ICN)*

ICN - WHC-SD-EN-AP-108.1R0

*A.*

**Document Number:** WHC-SD-EN-AP-108 **Revision Number:** 0

**Document Title:** , Interim-Status Groundwater Quality Assessment Plan for the 216-U-12 Crib

**Document's Original Author:** Williams, B. A. and C. J. Chou

**Effective Date of ICN:** 9/23/97

**Change Requested by:** Williams, B. A.

***B.*** **Action:** Strike out and/or add the changes on the pages defined in Section D. below. Reference ICN number on the affected pages of the original document, initial, and date. Attach ICN to document.

***C.*** **Effect of Change:**

This ICN updates the assessment plan to comply with federal and State regulations and includes references to new procedures and project quality assurance requirements.

***D.*** **Reason for Change/Description of Change:**

Reason for Change:

These changes update the status of the Resource Conservation and Recovery Act (RCRA) interim-status groundwater quality assessment plan for the 216-U-12 Crib.

Description of Change:

1.0 Introduction

Page 1, 1st paragraph, 3rd sentence - strike out "is" and replace with "was" ("…waste disposal facility, was operated by the Westinghouse Hanford Company…"). Add the following sentence to the end of 1st paragraph, "All groundwater compliance monitoring is conducted by the Hanford Groundwater Monitoring Project, PNNL."

Page 1 - add the following after the 2nd paragraph, "The *Results of RCRA Groundwater Quality Assessment Program at the 216-U-12 Crib* (Williams and Chou 1997) conclude that the 216 U-12 Crib is the source of the elevated specific conductivity and the specific constituents nitrate and calcium. Technetium-99 has also been identified as a contaminant from the crib.

Based on the results and conclusions of the RCRA phase I and II assessment published in Williams and Chou (1997), the crib, until closed, must remain in RCRA interim-status assessment monitoring because of continuing elevated levels of specific conductivity [40 CFR 265.90(d)(4)].

This revised groundwater quality assessment monitoring plan will focus on 1) determining whether the flux of constituents out of the vadose zone into the groundwater is increasing, staying the same, or decreasing; 2) monitoring the known contaminants until a near-term interim corrective action is defined; and/or 3) monitoring under interim-status assessment until a final-status or alternative monitoring plan is implemented during closure of the facility.

The results of this interim status assessment monitoring program will provide groundwater contaminant concentration data which will be evaluated, along with other groundwater data from the 200-UP-1 Operable Unit (OU) to determine the appropriate closure for the facility. According to the Hanford Site RCRA Facility Permit (DOE 1996) modification schedule, the U-12 Crib will be closed in 2003.

The nitrate plume covers a large area and is comprised of commingling plumes from several sources including the U-12 Crib. The Ecology and EPA have determined, in the interim remedial measures for the 200-UP-1 OU, that nitrate will not be remediated until practical treatment options are available (Swanson 1996). The DOE has designated the Environmental Restoration Contractor (ERC) to close all RCRA sites including the 216-U-12 Crib. The ERC is responsible for conducting groundwater remediation, as specified, as part of the CERCLA Operable Unit Records of Decision (ROD)."

**3.0 Site Description**

Page 2 - add before 1st paragraph, "Updated descriptions and interpretations of the Hanford Site hydrogeology are presented in the groundwater annual reports (e.g., Hartman and Dresel 1997). Site-specific hydrogeology at the U-12 Crib is summarized below."

Page 4, Section 3.2.5 - change 1st paragraph, 3rd sentence to, "...is approximately 137 m (449 ft) above mean sea level and declining." Change 4th sentence to, "...depth to the water table is from 73.8 m to 74.4 m (242 ft to 244 ft) below land surface." Change 5th sentence to, "The June 1996 water table map (Hartman and Dresel 1997)...."

**4.0 Description of Existing Groundwater Monitoring System**

Page 5, 1st paragraph, 1st sentence - delete "present."

Page 5, Section 4.1 - rewrite 1st sentence as, "The detection level groundwater monitoring network for the U-12 Crib consisted of..."

Page 6, Section 4.2 - delete last sentence.

Page 6, Section 4.3 - change last sentence to, "All available data results of the groundwater sampling and analysis are recorded in HEIS."

Page 7, Section 4.4 - delete last paragraph and replace with, "The *Results of RCRA Groundwater Quality Assessment Program at the 216-U-12 Crib* (Williams and Chou 1997) conclude that the 216 U-12 Crib is the source of the elevated specific conductivity (attributed to nitrate and calcium) in downgradient wells 299-W22-41 and 299-W22-42. Technetium-99 has also been identified as a contaminant from the crib."

**5.0 Groundwater Quality Assessment Program**

Page 7 - delete 1st paragraph.

**5.1 Investigatory Approach**

Page 8 - delete second paragraph and insert, "The groundwater quality assessment program will continue under a phase II assessment strategy that incorporates a regional perspective.

Because the 216-U-12 Crib (U-12 Crib) is the source of nitrate, calcium, and technetium entering the groundwater, federal regulations [40 CFR 265.93(d)(4)] require that the owner must continue to determine the "(i) rate and extent of migration of the hazardous waste or hazardous waste constituents in the groundwater; and (ii) the concentration of the hazardous waste or hazardous waste constituents in the groundwater," until final closure of the facility.

From now until closure of the U-12 Crib the assessment will focus on (1) monitoring the key point of compliance wells to evaluate whether known contaminant concentrations are increasing, decreasing or staying the same; (2) evaluating water level data to assess changes in groundwater flow direction; and (3) integrate the TSD-specific network into a sub-regional monitoring network (using well data from other programs and/or networks) to support continued plume tracking (rate and extent). Any required groundwater cleanup and/or corrective action will be the responsibility of the Environmental Restoration Contractor as defined by the DOE-RL.

Since the U-12 Crib has been decommissioned and is not actively receiving effluent, the magnitude and significance of continued nitrate and technetium-99 contaminant contributions from the U-12 Crib to the known regional plumes is expected to be decreasing. Based on this scenario, and as substantiated by continued monitoring at the crib, further installation of wells to expand the U-12 Crib assessment monitoring network is not recommended. Because wells in the network go dry (due to 200-Area water table declines), wells will be replaced only if they are required to meet the Washington Administrative Code (WAC) regulations. In the future, replacement wells will be proposed only if they support the Data Quality Objectives (DQOs) that are being developed for a proposed subregional network. While still in the planning stages, subregional networks are designed to delineate and track the known plumes, and the monitoring wells are strategically placed to evaluate the continuing status of the groundwater at Hanford. The basis for this modified network is described in detail in the next section."

**5.2 Groundwater Quality Assessment Monitoring Network**

Page 8 - delete paragraph and replace with, "The groundwater quality assessment monitoring network will be modified during FY 1998 because, based on water level predictions, downgradient wells 299-W22-40 and 299-W22-42 will go dry during CY 1998. The current groundwater quality assessment monitoring network consists of five wells -- the four original network detection wells, 299-W22-40, -41, -42, -43, and 699-36-70A (added during the initial phase II assessment in CY 1994).

Well 299-W22-40 (W22-40) will not be replaced when it goes dry because analysis of the groundwater flow direction indicates that this well is adjacent to but not downgradient of the U-12 Crib. This is corroborated by the groundwater chemistry results that, to date, reveal conditions similar to the background or upgradient well.

Well 299-W22-42 (W22-42) will require deepening or a replacement well within 15 m (50 ft) of the original well because W22-42 provides assessment of contaminants leaking into the aquifer below the U-12 crib. This well is one of two wells (W22-41 and W22-42) that triggered the site into assessment. Chemistry results from both wells continue to exceed the background critical mean for specific conductance. Technetium-99 is also elevated in both wells. Efforts to evaluate the technology to deepen RCRA and/or WAC-compliant "resource protection" wells is underway. The results will be used to determine whether a replacement well is the chosen option.

This modified network will contain one less well than the existing network but will still meet the requirements for one upgradient and three downgradient wells.

This assessment network must be maintained until the facility is closed under RCRA regulations or a subregional approach to groundwater monitoring is approved and implemented.

The replacement or deepening of well 299-W22-42 will be completed in the uppermost portion of the unconfined aquifer consistent with the other wells in the network. The installation and completion depth of the new well is summarized in Section 5.7. Well W22-42 will be replaced or deepened during CY 1998. In accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1994) and as specified in TPA M-24-00, an interim milestone will be established for the new network well."

**5.3 Water Table Monitoring**

Page 8 - delete paragraph and replace with, "The water level monitoring network will include only the active wells in the network. Currently, this network includes wells W22-40, -41, -42, -43 and 699-36-70A. Wells W22-40 and -42 will be dropped from water level monitoring when they go dry. The proposed new replacement well for W22-42 will be added if it is the chosen method (versus deepening W22-42). Measurement frequencies for wells in the monitoring network will be quarterly. Water level data collected from surrounding CERCLA UP-1 OU wells and sitewide-monitoring wells will provide additional information for interpretation of the groundwater flow direction."

**5.4 Groundwater Quality Assessment Sampling Schedule**

Page 9 - delete section and replace with, "The wells defined in the groundwater quality assessment monitoring network will be sampled quarterly for the field parameter's specific conductivity and pH and site-specific parameters. The network wells will be sampled annually for ICP metals and Iodine-129. The new well, if needed, will include the above list of constituents and the Appendix IX constituents.

Table 5-1 provides the list of network wells, analytical constituents, and sampling frequency for the continued U-12 Crib assessment. The analytical list and groundwater assessment monitoring schedule has been modified based on the objectives of the assessment groundwater monitoring program at the U-12 Crib."

**5.5 Schedule of Implementation**

Page 9 - delete this section and replace with, "The modified groundwater quality assessment monitoring program will be implemented during the next scheduled monitoring event. The assessment monitoring schedule will remain in effect until either 1) the network goes back to detection (i.e., as a result of groundwater remediation or corrective action), 2) the U-12 Crib is closed under final status, or 3) the Ecology approves a variance or an exemption to the current assessment monitoring program."

**5.6 Sampling and Analytical Methods**

Page 9 - delete section and replace with, "Groundwater sampling is performed by a subcontractor to PNNL who is required to use controlled procedures (currently WMFS 1997) based on standard methods for groundwater sampling. The sampling requirements, including quality control requirements, are specified in a Statement of Work (SOW). These sampling requirements include requirements for procedures, containers, transport, storage, chain of custody, and records management. Preservation techniques, analytical methods used, and current detection levels of the constituents sampled for at the U-12 Crib are in accordance with the *Test Methods for Evaluating Solid Wastes* (EPA 1986b) or approved standard methods and listed in the *Hanford Groundwater Monitoring Project Quality Assurance Project Plan* (PNNL 1997)."

**5.7 Phase II -- Plume Investigation**

Page 9 - replace entire section with, "**5.7 Phase II -- Drilling and Well Installation**
If the deepening of the existing well (W22-42) is not feasible, one new replacement groundwater monitoring well will be proposed. The borehole will be located between W22-42 and W22-41, as close as possible to W22-42.

The proposed well will be completed within the upper 10 m (35 ft) of the aquifer with a total depth of approximately 84 m (275 ft). Well drilling and construction design specifics will be provided to the drilling contractor via a Statement of Work (SOW). The well will be drilled using air rotary or cable tool techniques following the contractors applicable procedures. The well will be completed as a shallow groundwater monitoring well that will meet the requirements for an RCRA-compliant "resource protection well" as defined in the WAC 173-160. The well will be equipped with surface well head protection, locking cap, and a dedicated sampling pump. Since this well is a replacement for W22-42, there will be no characterization sampling required during drilling. As a routine effort, soil samples will be collected every 5 ft or at changes in lithology to provide a geologic description, including mineralogy, grain size distribution, etc. Soil and groundwater sampling for physical and/or chemical analysis will not be required for this well.

Geophysical logging, using the RLS spectral gamma probe will be performed to aid in hydrogeologic correlation and to screen for radioactive contaminants and anomalous intervals in the borehole. While offset well log results do not indicate any radiological "hot" intervals, these logs provide a quick and inexpensive profile of the borehole, which can support clean closure of the facility, aid in geologic interpretations, etc. Geophysical logging will be performed after each temporary string of casing is placed and prior to downsizing for the next phase of drilling. If anomalous regions are identified, the RLS logging system may be rerun to obtain additional data for isotopic identity. The completed well will be developed to settle the filter pack around the screen and clean up the remnants of drilling.

Aquifer testing, either a slug or pumping test, will be performed after completion of the well. The new well will be sampled according to Table 5.1."

**6.0 QUALITY ASSURANCE PROGRAM**

Page 10 - delete this entire section and replace with, "Overall quality assurance (QA) program requirements are defined in PNNL 1997 and Ecology et al. 1994. Sample collection and analysis activities are conducted under guidelines specified in PNNL (1997). Currently, Quanterra Environmental Services (QES) in St. Louis, Missouri analyzes the samples for hazardous chemicals. The QES laboratory in Richland, Washington performs the radiochemical analysis. The quality control (QC) and quality assurance (QA) programs at QES are documented in a quality assurance manual and specific laboratory procedures."

**6.1 INTERNAL QC OF PARTICIPANT CONTRACTOR OR SUBCONTRACTOR LABORATORY**

Page 10 - delete this entire section and replace with, "Internal QC at the participant contractor, or subcontractor, laboratories include general practices applicable to a wide range of analyses, as well as specific procedures stipulated for particular analyses as outlined in PNNL 1997. All laboratories shall have a written plan covering their analytical methods and internal QA/QC project manuals, including blanks, spiked samples, surrogate samples, calibration standards and devices, and reagent checks. The services of alternate analytical chemistry laboratories may be procured for split sample analyses."

**6.2 EXTERNAL QC**

Page 10 - delete this entire section and replace with, "The external QC will use interlaboratory comparisons and blind, duplicate, and blank samples to evaluate for accuracy, precision, and contamination of results from the participant contractor, or subcontractor, laboratory. More specific requirements for external quality control can be found in PNNL 1997. A summary of this evaluation is provided in the RCRA quarterly report letters (e.g., Letter Report, PNNL to K. M. Thompson, DOE-RL, Dated 7/18/97, *Quarterly Resource Conservation and Recovery Act Groundwater Monitoring Data for the Period Jan. 1, 1997 through March 31, 1997*)."

**7.0 RECORD KEEPING AND REPORTING REQUIREMENTS**

Delete this entire section and replace with, "The U-12 Crib groundwater quality assessment program will continue until closure, corrective action, or State approved variance from interim status assessment monitoring. The results of the assessment will be reported annually, included in the Hanford Site groundwater monitoring annual report due to Ecology by March 1 of each year. The report will contain a discussion of the updated results of the assessment program and provide a recommendation to either reinstate groundwater monitoring under detection requirements or proceed with the groundwater quality assessment program. If a compliance-monitoring program is warranted during the closure of the facility, a revised plan will be prepared and written to final status requirements for compliance monitoring. Record keeping requirements of 40 CFR 265.94 will be followed (EPA 1980)."

**8.0 REFERENCES**

Add the following references:

Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, 1980, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Title 40, Code of Federal Regulations, Part 265, as amended, U.S. Environmental Protection Agency, Washington, D.C.

PNNL, 1997, *Hanford Groundwater Monitoring Project Quality Assurance Project Plan*, QA Plan ETD-102, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Swanson, L. C., 1996, *Engineering Evaluation/Conceptual Plan for the 200-UP-1 Groundwater Operable Unit Interim Remedial Measure*, BHI-00187, Bechtel Hanford, Inc., Richland, Washington.

WMFS, 1997, *Sampling and Mobile Laboratories Procedures*, SML-EP-001, Waste Management Federal Services, Inc., Northwest Operations, Richland, Washington.

Hartman, M. J., and P.E. Dresel, eds., 1997, *Hanford Site Groundwater Monitoring For Fiscal Year 1996*, PNNL-11470, Pacific Northwest National Laboratory, Richland, Washington.

Williams, B. A., and C. J. Chou, 1997, *Results of RCRA Groundwater Quality Assessment Program at the 216-U-12 Crib*, PNNL-11574, Pacific Northwest National Laboratory, Richland, Washington.

Page 31 - delete Table 5-1.

Page 32 - delete Table 5-2 and replace with:

**Table 5-1 GROUNDWATER ANALYSIS SCHEDULE FOR FY 1998**

| WELL | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-W22-40 | | | X | | | XZ | | | X | | | X |
| 2-W22-41 | | | X | | | XZ | | | X | | | X |
| 2-W22-42 | | | X | | | XZ | | | X | | | X |
| 2-W22-43[U] | | | X | | | XZ | | | X | | | X |
| 6-36-70A | | | X | | | XZ | | | X | | | X |
| NEW WELLS** | | | Y | | | XZ | | | X | | | X |

"X" LIST: Field parameters, site specifics sampled quarterly

| | | |
|---|---|---|
| Conductivity (field) | Gross Alpha and Beta | Anions |
| pH (field) | Tritium | |
| | Technetium-99 | |
| | TDS | |
| | Alkalinity | |

"Y" LIST: Indicator parameters, Appendix IX constituents, groundwater quality parameters and site specifics

| | | | |
|---|---|---|---|
| Conductivity (field) | Gross Alpha and Beta | Anions | ICP Metals (filtered) |
| pH (field) | Tritium | Cyanide | (As, Pb, Hg, Se, Ti) |
| TOX | Technetium-99 | Sulfide | |
| TOC | Iodine-129 | Pesticides | |
| | TDS | PCB | |
| | Alkalinity | Herbicides | |
| | Radium | Volatile Organics | |
| | Semivolatile Organics | Dioxin | |
| | Coliform | Dibenzofurans | |
| | Phenols | Organic Phosphate Pesticides | |

"Z" LIST: Sampled annually

ICP Metals (filtered)
Iodine-129

** = Sample for "Y" list only during 1st sampling period of new well
U = Upgradient well

*E.* **Approval Signatures:**
**(Please sign and date)**

**Type of Change: (Check one):**

**_ Minor X Major**

**Process**

**Quality Department:** T. L. Almeida T L Almeida **Date:** 9/19/97

**Approval Authority:** R. M. Smith R. M. Smith **Date:** 9/18/97

**Technical Approval:** B. A. Williams **Date:** 9/16/97

**Technical Reviewer:** S. P. Luttrell **Date:** 9/17/97

**Technical Reviewer:** M. J. Hartman Mary J Hartman **Date:** 9/18/97

**Technical Reviewer:** C. J. Chou Chaoming J. Chou **Date:** 9/16/97